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# NOTE ON TREMATODE SPOROCYSTS AND CERCARIÆ IN MARINE MOLLUSKS OF THE WOODS HOLE REGION.<sup>1</sup>

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In the summers of 1909 and 1910, while engaged in the study of the parasites of fishes at the laboratory of the Bureau of Fisheries, Woods Hole, Mass., I examined a number of invertebrates for larval stages of trematodes. The results of these examinations, although rather meagre with respect to the number of species found, are not without interest.

The following species of mollusks were examined: *Crepidula fornicata*, *C. plana*, *Ilyanassa obsoleta*, *Littorina littoria*, *L. rudis*, *Modiolus plicatulus*, *Mya arenaria*, *Mytilus edulis*, *Neverita duplicata*, *Pecten irradians*, *Purpura lapillus*, *Urosalpinx cineria*, *Venus mercenaria*. Besides these several species of crustaceans were examined, also one annelid, *Hydroides dianthus*.

Larval trematodes were found in only two species of mollusks, viz. *Ilyanassa obsoleta* and *Pecten irradians*. No trematode parasites were found in any of the crustaceans. A sporocyst found in the annelid, *Hydroides dianthus*, has already been reported.<sup>2</sup>

## I. SPOROCYSTS AND CERCARIÆ FROM *ILYANASSA OBSOLETA*. FIGURES 1-6.

Snails of this species were examined on six occasions. In all but one of these examinations sporocysts were found. On each occasion a considerable number of the snails were examined with much care, the several organs being teased under a lens. None of the sporocysts, however, were seen in place, in all cases having been found lying at the bottom of the dish in which the snails had been dissected.

The following extracts from my notes made at the time of

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<sup>2</sup> BIOLOGICAL BULLETIN,

collecting will give details of frequency of occurrence with such other observations as seem to be appropriate.

1909. July 3, 34 snails examined, no parasites found.

July 19, 110 snails examined, 21 sporocysts found. The sporocysts were inactive and contained tailless cercariae which were very active. So far as examined the sporocysts in this lot

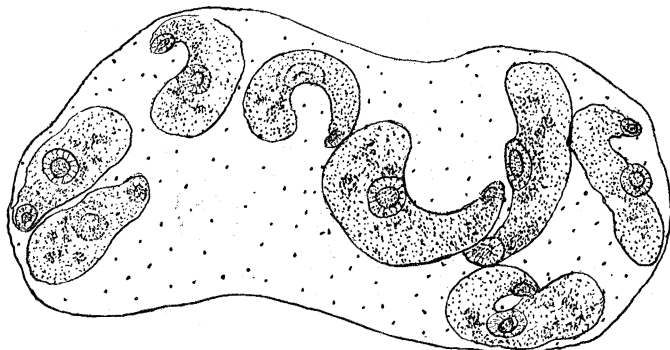


FIG. 1. Sporocyst containing cercariae, from *Ilyanassa obsoleta*; in sea water flattened under cover glass. Length 0.86 millimeter.

contained relatively few cercariae, 9 being the greatest number seen, and as few as 2 noted in one sporocyst.

Three sporocysts lying free in sea water had the following dimensions in millimeters:

Length.....	0.62	0.75	0.88
Breadth.....	0.30	0.26	0.30

Two cercariae, killed under cover-glass over flame, had the following dimensions:

Length.....	0.31	0.42
Breadth, anterior.....	0.05	0.07
middle.....	0.13	0.14
posterior.....	0.06	0.06
Anterior sucker.....	0.04	0.05
Ventral sucker.....	0.07	0.06

July 20, 120 snails from North Falmouth. A dozen or more of these were dissected under a lens in the endeavor to find exactly where the sporocysts occur but without finding any in place. All the snails were then picked to pieces, washed, and the

water decanted. About 100 sporocysts were obtained. These lay motionless on the bottom of the dish. They were easily seen on a black background, being whitish translucent. They were short oblong with rounded ends, often slightly arcuate.

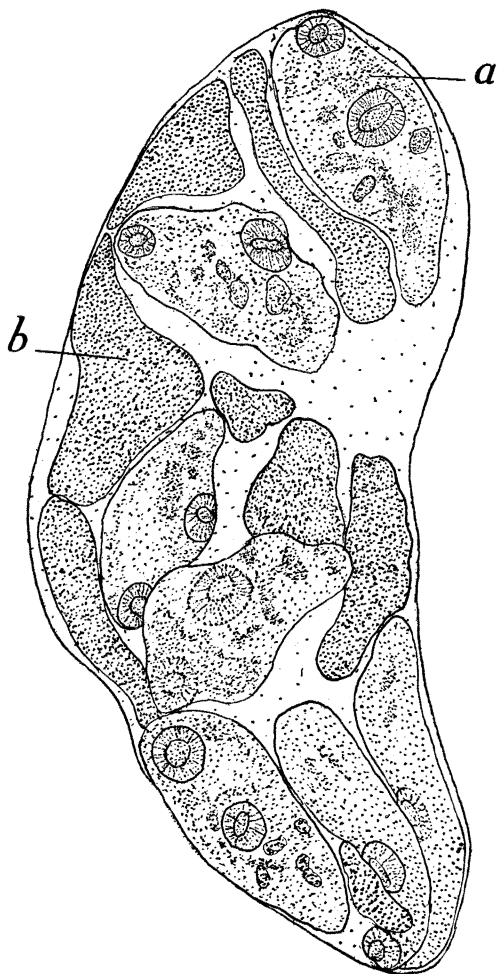


FIG. 2. Sporocyst from *Ilyanassa obsoleta*, flattened under cover glass, fixed over flame, stained and mounted in balsam. *a*, cercariæ. *b*, germinal cell masses and young stages of cercariæ. Length of sporocyst 0.80 millimeter.

July 22, about 300 snails from Tarpaulin Cove were broken open and about 80 of them removed from their shells. A few of these were looked over carefully, much of the material being

teased and examined with the aid of the compound microscope. No sporocysts were seen in place. Sporocysts were found on the bottom of the dish in which the snails that had been removed from their shells were lying, also in the dish which held the snails still in the broken shells. It would appear that the sporocysts

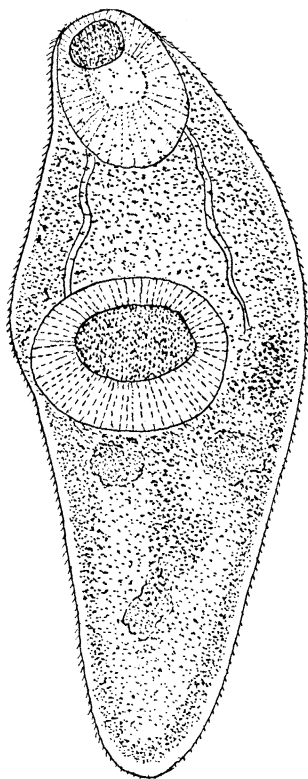


FIG. 3. Cercaria in sea water, ventral view, showing excretory vessels in front of ventral sucker, rudiments of testes, etc. Length 0.25 millimeter. From *Ilyanassa obsoleta*.

are rather loosely lodged in the mantle cavity, since they make their appearance when the broken shells and partly exposed animals are shaken about in the water. Some 600 sporocysts were obtained from this lot in a short time in this way. When the snails were picked to pieces, washed, and the water decanted, an increased number of sporocysts were obtained. The number of cercariæ in these sporocysts was greater than that recorded in the

lot collected on July 19. One sporocyst when opened liberated 40 cercariæ. Some of these were immature. An anterior spine was noted for the first time on these cercariæ. It is embedded in the tissues of the head and may be seen protruding its sharp tip at the extreme anterior end in certain stages of extension while the cercaria is actively contracting. What were taken to be excretory vessels were seen extending from near the lateral margins of the oral sucker. They appear to unite in front of the oral sucker and again behind the ventral sucker. There was a large and conspicuous excretory space near the posterior end which communicated with the terminal pore by a slender canal.

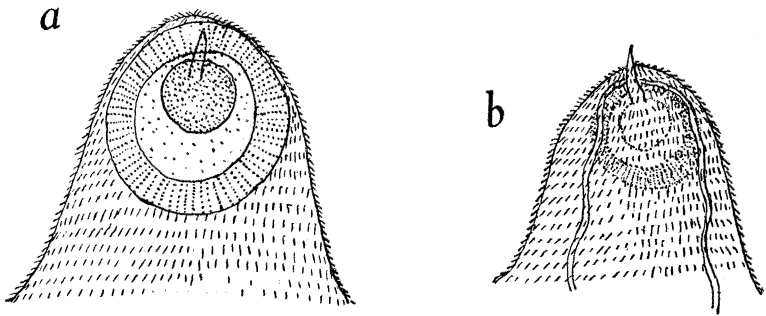


FIG. 4. Free-hand sketches of anterior end, life; showing oral spine, minute spines on surface of body, and anterior excretory vessels. *a*, dorsal view. Diameter of oral sucker 0.04 millimeter. *b*, Ventral view of another specimen. Diameter of oral sucker 0.06 millimeter; length of oral spine 0.017 millimeter. From *Illyanassa obsoleta*.

A cercaria, flattened slightly and fixed over the flame, had the following dimensions in millimeters: Length 0.24, breadth 0.10, oral sucker 0.041, ventral sucker 0.057, length of anterior spine 0.020. The posterior end was truncated as if slightly retracted.

July 23, 50 snails from a small salt water pond were removed from their shells and carefully dissected; about 350 others were broken open and stirred about vigorously. After a careful search 14 sporocysts were found. The pond from which these snails came, while salt, did not have free communication with the sea.

In 1910 a lot of snails that had been kept in a dish of sea water for several days were opened on different dates with the following results:

August 24, 24 snails were removed from their shells, picked to pieces with forceps, washed, the water decanted, and about 10 sporocysts found. These were linear oblong, frequently arcuate and slipper shaped, thickish. Dimensions in millimeters:

Length.....	0.66	0.56	0.60	0.56	0.70	0.55
Breadth.....	0.25	0.26	0.25	0.25	0.33	0.25

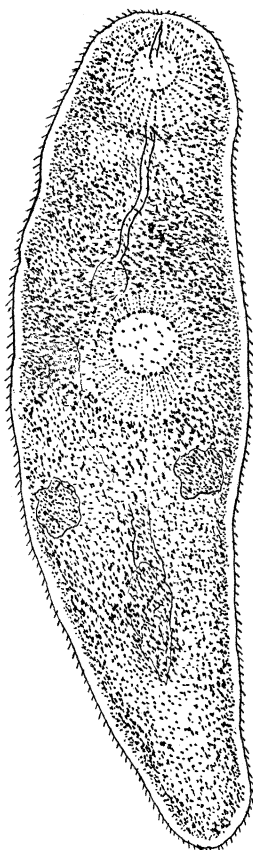


FIG. 5. Cercaria from *Ilyanassa obsoleta*, stained and mounted in balsam, dorsal view, showing oral spine, rudiments of prepharynx, pharynx, testes, etc. Length 0.30 millimeter.

August 26, 24 snails were examined that had been opened and removed from their shells the day before. No sporocysts were found. Another lot of 24 were opened and examined on this date. No sporocysts were found.

August 29, 36 snails examined in the usual way. No sporocysts were found.

The following notes were made on material that had been stained and mounted in balsam.

The shape of the cercariæ varies greatly but seems to be due to

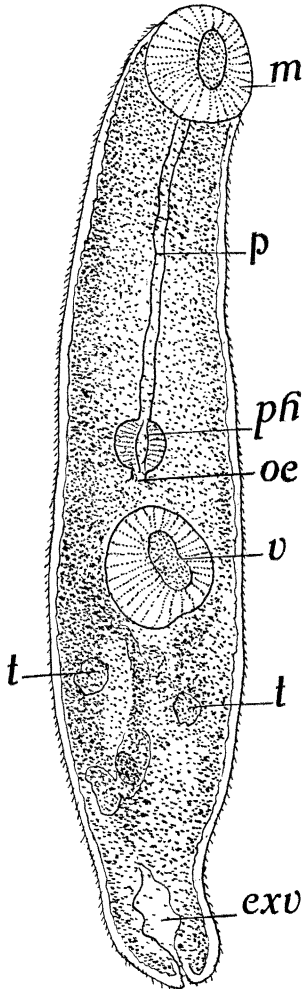


FIG. 6. Cercaria from *Ilyanassa obsoleta*, in balsam. Length 0.30 millimeter. *exv*, excretory vessel; *m*, oral sucker; *oe*, esophagus; *p*, prepharynx; *ph*, pharynx; *t*, testes; *v*, ventral sucker.

different methods of fixing, or, at least to different degrees of contraction. When fixed under pressure they are more or less



elongated. When much flattened they are usually long ovate, the greatest width being at the ventral sucker, which is near the middle of the length, thence they taper towards each extremity but more towards the posterior than the anterior end. When less compressed they may be long fusiform, or subcylindrical. The body is covered throughout with exceedingly minute spines. When the cercariæ are fixed without pressure they may be ovate, short fusiform, always thickish, frequently arcuate, the neck especially having a tendency to be bent ventrad. The suckers are nearly equal but there appears to be some variation. In

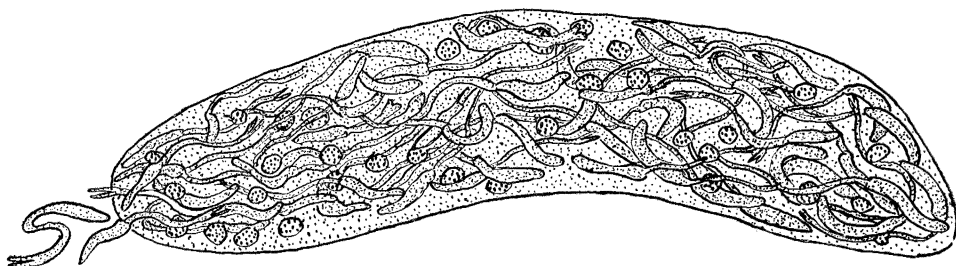


FIG. 7. Sporocyst with cercariæ, from *Pecten irradians*, life, under slight pressure; two cercariæ escaping from one end of sporocyst. Length 1.78 millimeter.

most cases the ventral sucker is slightly larger than the oral. The apertures of the suckers are variable depending on the state of contraction when fixed. Frequently the aperture of the ventral sucker is transverse. In one case it was elongated axially. The aperture of the oral sucker was in most cases nearly circular. The pharynx is subglobular and lies near the anterior border of the ventral sucker. The intestinal rami were not distinctly shown. The anterior spine is not easily seen in the mounted specimens. The stained and mounted material does not usually show more of the excretory system than the posterior vessel which is very conspicuous in the living worms. In some of the mounted specimens this posterior vessel was evident; in others it could not be distinguished. In the flattened, oval individuals it was not seen (fig. 5). In the cylindrical forms it was usually visible (fig. 6). Rudiments of reproductive organs appear in all the older cercariæ. The most conspicuous of these are two lat-

erally placed subglobular bodies which are situated a short distance behind the ventral sucker. These I take to represent the

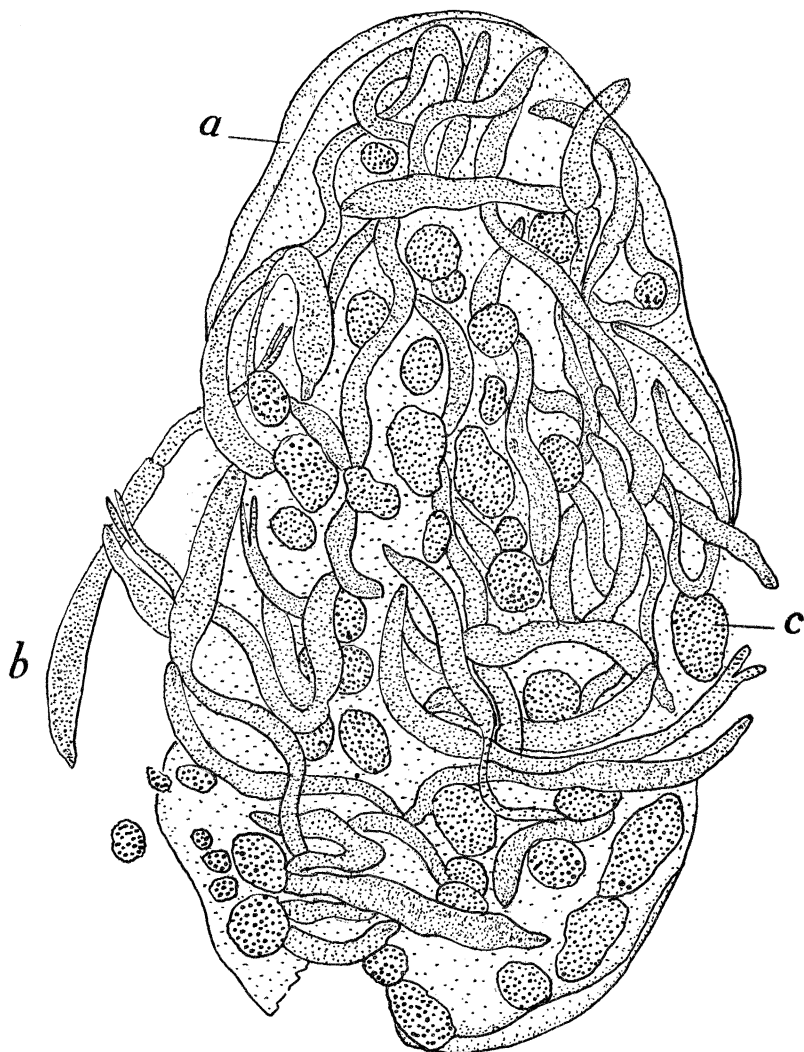


FIG. 8. Sporocyst with cercariæ, from *Pecten irradians*, stained and mounted in balsam; slightly crushed under the cover glass. *a*, wall of sporocyst; *b*, cercariæ; *c*, germinal cell masses and young stages of cercariæ. Length 0.60 millimeter.

testes. In front of the left testis may be seen, in some, a granular mass opposite the left posterior margin of the ventral sucker

(figs. 3 and 5). This is probably the ovary. Behind the testes on the median line is a dense granular mass which is doubtless the beginning of the uterus. Granular masses which fill the body, but are most dense along the lateral margins may represent the beginnings of diffuse vitellaria.

The cercariae of this species resemble *Cercaria linearis* Lesper, but the sporocysts are different.

## 2. SPORO CYSTS AND CERCARIAE FROM PECTEN IRRADIANS. FIGURES 7-10.

In the summer of 1909 I examined 361 scallops on nine dates from July 3 to August 27 but found no sporocysts. In August, 1910, I examined 6 large scallops from Quisset Harbor. They had been kept in a vessel of sea water in the laboratory for two days before they were examined. After removing one valve the animals were shaken vigorously in sea water. A few small sporocysts were found in the bottom of the dish in which the scallops had been shaken. The scallops themselves were then examined carefully for sporocysts but no more were found. The sporocysts were elongate and slowly contractile with a tendency to become arcuate. The larger examples at rest in sea water measured 0.70 millimeter in length and 0.42 in breadth; length of one of the smaller specimens 0.30, breadth 0.15. A specimen compressed under a cover glass was 1.78 in length and 0.36 in breadth. These sporocysts contained numerous slender, tailed cercariae. One of the latter in alcohol was 0.40 in length and 0.024 in breadth; another, length 0.20, breadth 0.027, length of body 0.085, length of tail 0.115. The first sporocyst examined had what appeared to be an actively contractile papilla at each extremity. These apparent papillae proved to be cercariae partially liberated from the sporocyst, but evidently held by the wall of the sporocyst contracting around them. All the cercariae, both in the living and preserved specimens, are long and slender, the tail, in all cases, except immature specimens, being considerably longer than the body. In fully extended examples the tail may be two or three times as long as the body. When they are liberated from an active sporocyst they exhibit a peculiar jerking movement of the tail and posterior half of the body,

the anterior end meanwhile being bent ventrad and performing a kind of pecking movement. This characteristic behavior of the anterior end is plainly in part due to the jerking movements of the posterior portions, and in part to the alternate protrusion and retraction of a short, proboscis-like organ at the anterior end. These movements suggest adaptations to enable the cercariæ to penetrate the soft membranes of the secondary host. In some freshly liberated individuals a thin, hyaline, membranous, fin-like border was distinguished. On one of these cercariæ this membrane was observed to be broken up into slender rod-like processes which resembled long cilia. The posterior extremity is divided into two slender branches. This forked extremity was also seen to be surrounded by a thin membrane in some fresh specimens. The structure of both body and tail is coarsely granular. Rudiments of what probably represent the oral sucker, and the pharynx were distinguished. When a sporocyst is crushed, there are seen, in addition to the cercariæ, of which there may be many stages of development, some granular material and balls of cells.

While the prevailing shape of these sporocysts is long and slender considerable variation exists. Both sporocysts and cercariæ are much like those found in the annelid *Hydroides dianthus*. The cercaria resembles *Cercaria cristata* La Valette.

### 3. PEARLS.

While the examination of numerous specimens of the edible mussel (*Mytilus edulis*) resulted negatively, so far as trematode larvæ were concerned, a few cysts were noted, some of which may have been caused by trematodes. At my request Dr. Irving A. Field, who was opening large numbers of mussels in connection with his study of the development, and experimental work on the food value of this mollusk, handed to me those that in any way appeared to be abnormal. The number of such was small.

On July 24, 1909, 2 mussels were brought to me by Dr. Field, which he thought to be in poor condition. They had been cooked, so that there was no opportunity to examine them alive. One of them had about 15 cysts from 0.5 to 2 millimeters in diameter, along the edges of the mantle, and 4 on the foot, 1.5 to

2.5 millimeters in diameter. One of these cysts when crushed proved to be filled with small granular cells irregular in outline. Besides these, 3 small pearls were found in the mantle. There were a number of small white cysts embedded in the mantle of the other mussel. These contained pearls, 58 small pearls having been obtained from them. Some of them were multiple. They measured from 0.3 to 1.12 millimeters in diameter.

On August 11 some small cyst-like yellowish masses of similar appearance to those collected on the 24th, were found on the foot and mantle of a mussel. Their contents resembled leucocytes. A smear preparation revealed round cells of different sizes, the prevailing size being about 0.01 millimeter in diameter, with very strongly staining nuclei. A very careful examination of over 100 mussels made on different dates failed to yield any parasites.

It is perhaps worthy of note that the redia stage is omitted from the larval stages of trematode development which I have found in the invertebrates of the Woods Hole region.

Reference may here be made also to another abbreviated trematode life history in the case of the distome, *Parorchis avitus*, from the Herring Gull,<sup>1</sup> where miracidia, still within the ova in the later folds of the uterus, contained each a single well-developed redia.

<sup>1</sup> *Proceedings of the U. S. National Museum*, 46: 551-555.